MIXING A COVERT AND A NON-COVERT USER

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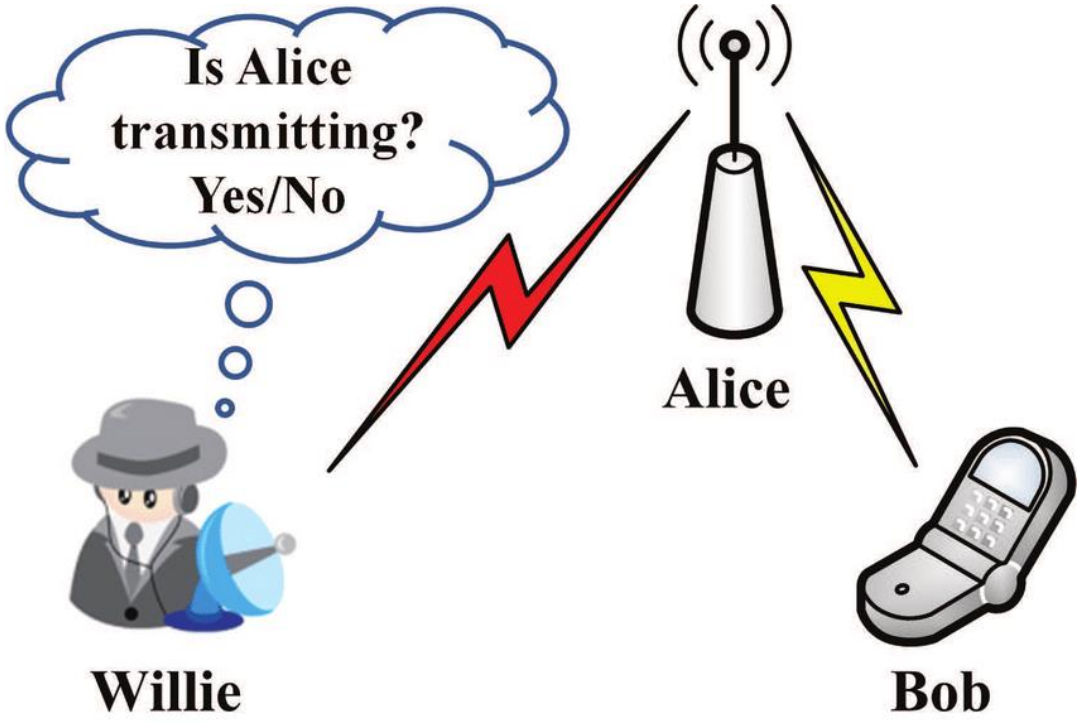
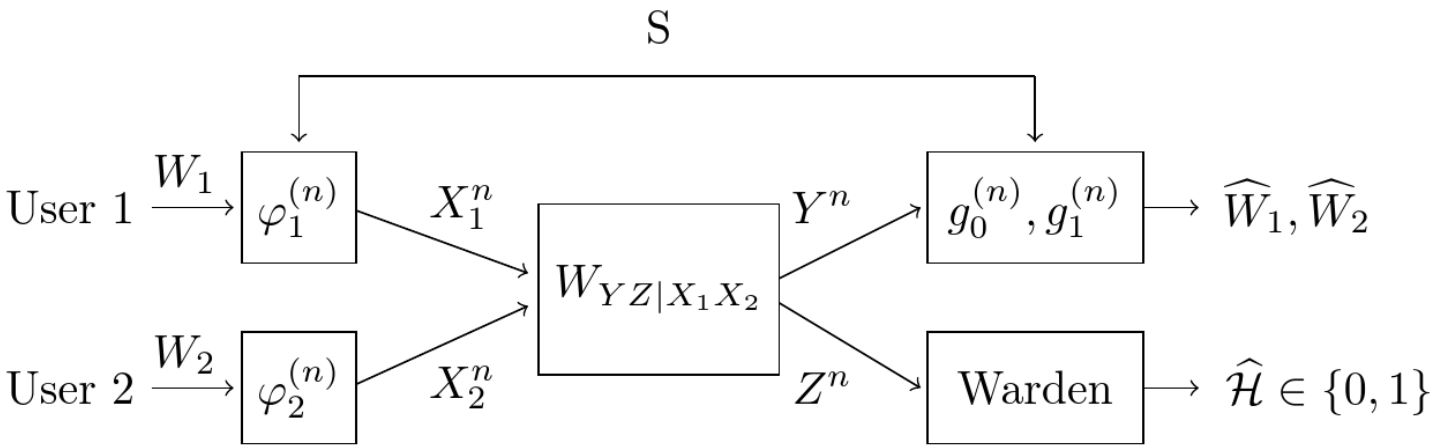
COVERT COMMUNICATION



Communication must be:

- Reliable
- Undetectable by other users.

OUR SETUP



We show that:

- It is possible to remain covert while other non-covert users are present.
- The presence of a non-covert user can be beneficial for improving the covert capacity of the other user.

MAIN RESULT

THEOREM 1

A rate-triple (r_1, r_2, k) is achievable, if and only if, for some pmf P_{TX_2} over $\mathcal{T} \times \mathcal{X}_2$ and $\epsilon_1, \epsilon_2 \in [0, 1]$ the following three inequalities hold:

$$r_2 \leq \mathbb{I}(X_2; Y \mid X_1 = 0, T),$$

$$r_1 \leq \sqrt{2} \frac{\mathbb{E}_{P_{TX_2}}[\epsilon_T D_Y(X_2)]}{\sqrt{\mathbb{E}_{P_{TX_2}}[\epsilon_T^2 \cdot \chi_{2,Z}(X_2)]}},$$

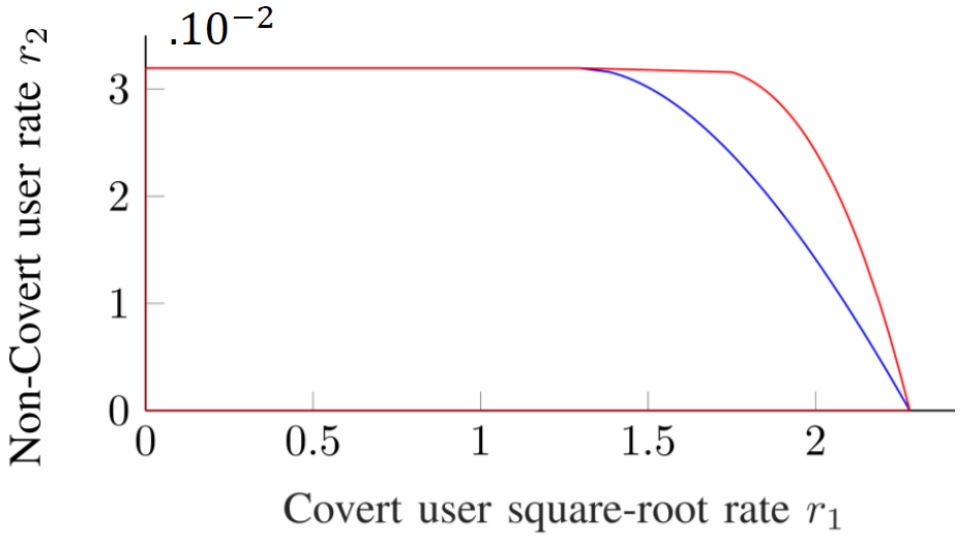
$$k \geq \sqrt{2} \frac{\mathbb{E}_{P_{TX_2}}[\epsilon_T (D_Z(X_2) - D_Y(X_2))]}{\sqrt{\mathbb{E}_{P_{TX_2}}[\epsilon_T^2 \cdot \chi_{2,Z}(X_2)]}},$$

where for the right-hand sides of (10) and (11) we define $0/0 = 0$ and for any $x_2 \in \mathcal{X}_2$

$$D_Y(x_2) \triangleq \mathbb{D}\big(W_{Y|X_1X_2}(\cdot|1, x_2) \,||\, W_{Y|X_1X_2}(\cdot|0, x_2)\big)$$
$$D_Z(x_2) \triangleq \mathbb{D}\big(W_{Z|X_1X_2}(\cdot|1, x_2) \,||\, W_{Z|X_1X_2}(\cdot|0, x_2)\big)$$
$$\chi_{2,Z}(x_2) \triangleq \chi_2\big(W_{Z|X_1X_2}(\cdot|1, x_2) \,||\, W_{Z|X_1X_2}(\cdot|0, x_2)\big).$$

SIMULATIONS

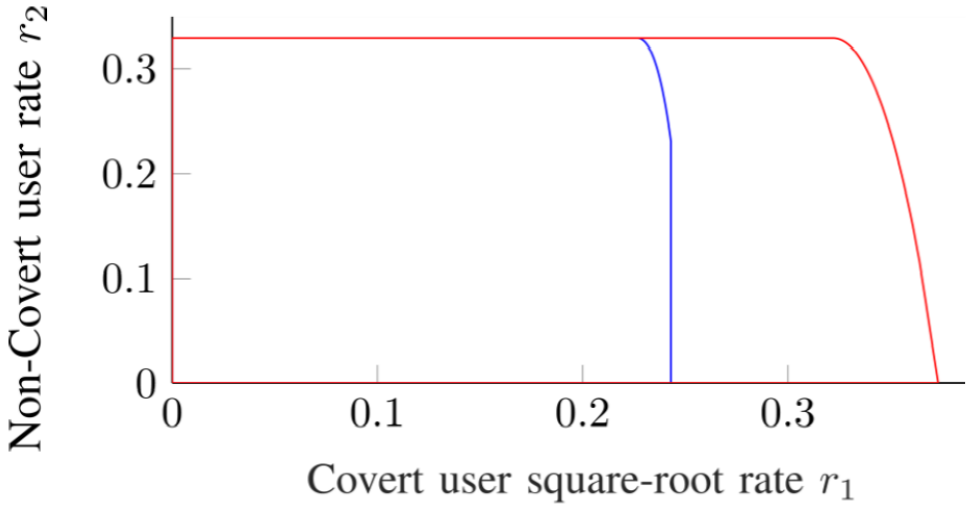
Time-sharing improves the rates



- With time-sharing | T | = 2 (in red)
- With time-sharing | T | = 1 (in blue)

SIMULATIONS

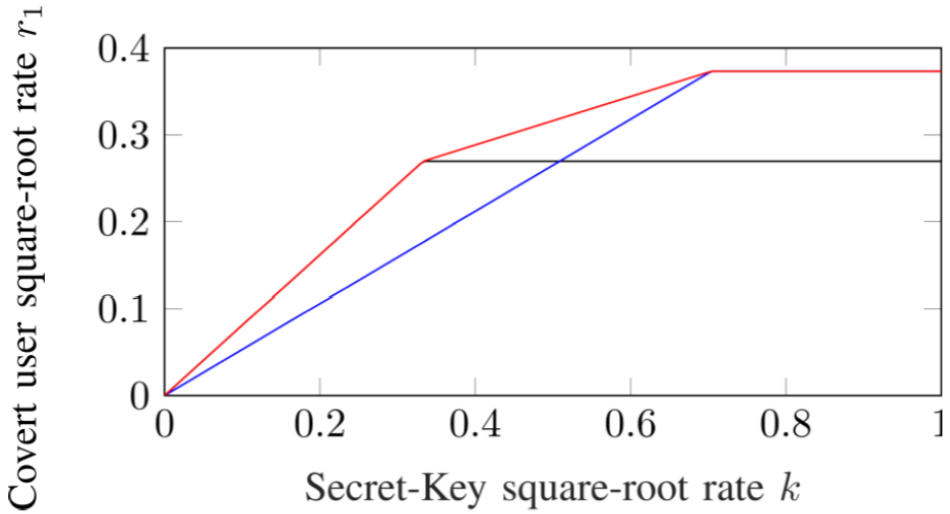
Higher secret-key rates k improves the rate-region



- Key-rates k $\leq$ 0.8 at User 2 (in red)
- Key-rates k $\leq$ 0.3 at User 2 (in blue)

SIMULATIONS

The non-covert user simulates channel states



- Constant channel input $X_2 = 0$ at User 2 (in blue)
- Constant channel input $X_2 = 1$ at User 2 (in black)
- Non constant channel input X_2 at User 2 (in red).

OUTLOOKS

- Generalize to the setup of multiple covert and non-covert users.
- Resource Allocation with Deep Reinforcement Learning.

Thanks!